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SCIENCE

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ONE HUNDRED AND FIFTY YEARS OF MUSEUM HISTORY[1]

WE have come together here to celebrate a dual anniversary—the anniversary of the founding of the Charleston Museum and the anniversary of the inception of the museum idea in the New World. That this idea has been a fruitful one is evidenced by the long roster of museums represented in this national association. It would be inappropriate for us to meet this year in any less historic place than Charleston.

In behalf of the American Association of Museums it is my duty and my privilege to pay homage to the broad vision of the founders of The Charleston Museum, to honor the city of Charleston for its steadfast preservation and nurture of the institution through the vicissitudes of a hundred and fifty years, and to congratulate the present generation of Charlestonians upon the youthful vigor of their venerable museum.

In behalf of the Charleston Museum it is but fitting that some of the more significant features of its history should be reviewed on its sesquicentennial anniversary.

The museum was founded in 1773 by the Charles-Town Library Society, to which belongs the credit of conceiving the museum idea, or at least of first giving it formal expression. This was done in a document so thoroughly worthy of the movement it initiated that I shall read it in full:

THE LIBRARY SOCIETY OF CHARLES-TOWN[2]

Taking into their consideration the many advantages and great credit that would result to this Province from a full and accurate Natural

[1] Address delivered at the anniversary session of the American Association of Museums, in its eighteenth annual meeting, held at Charleston, S. C., April 4, 1923.

[2] *South Carolina Gazette* (Powell's) of March 22 and April 5 and 12, 1773. *South Carolina Gazette* and *Country Journal* of March 30 and April 6, 1773.

History of the same, and being desirous to promote so useful a design, have appointed a committee of their number to collect and prepare materials for that purpose.

That this may be done in the most complete and extensive manner, *they do now invite* every gentleman who wishes well to the undertaking, especially those who reside in the country, to cooperate with them in the advancement of this plan. . . . For this purpose, the Society would request such gentlemen to procure and send to them all the natural productions, either animal, vegetable, or mineral, that can be had in their several bounds, with accounts of the various soils, rivers, waters, springs, etc., and the most remarkable appearances of the different parts of the country.

Of the animal tribe they would wish to have every species, whether terrestrial or aquatic, *viz.*, quadrupeds, birds, fishes, reptiles, insects, worms, etc., with the best accounts of their customs and natural habitudes.

Of vegetables they will thankfully receive every kind, from the loftiest tree in the forest to the smallest plants of the fields. . . . A complete specimen of any tree or plant will be two small branches of each, one having the flower in full blossom and the other the ripe fruit. . . . At the same time the Society beg to be furnished with the best accounts that can be given of the uses and virtues, either in agriculture, commerce or medicine, of which such tree or plant is possessed —the soil in which it most commonly grows—the season in which it flowers and when it bears its fruit.

They would be glad to be furnished also with specimens of all the various fossils, minerals and ores, the different soils, earths, clays, marles, stones, sands, shells, etc., the productions of this Province, with the best accounts of their several natures, qualities, situations and uses.

The Society, in order that this design may be carried into immediate execution, have fitted up a museum for the reception and preservation of specimens of these several natural productions and have appointed Charles Cotesworth Pinckney and Thomas Heyward, Jun., esquires, with Alexander Baron and Peter Fayssoux, physicians, in *Charles-Town*, to receive them, to whom all letters of intelligence, specimens, etc., are to be addressed.

And they flatter themselves, that the evident utility of the plan will engage such a number of public spirited gentlemen to assist them that they will soon be able to make a considerable progress. . . . They will not only gratefully receive all such communications and apply them in the best manner they can for the above purposes, but the names of all such shall be recorded as promoters of and contributors to so useful a work.

Any expense that may be incurred by forwarding letters of intelligence, specimens, etc., to town the Society will cheerfully repay.

By order of the Committee,

JOHN MURRAY,
Chairman.

The purpose of a local museum could hardly be better expressed to-day and the importance of local collections needs to be stressed in all natural history museums.

In 1814 the Literary and Philosophical Society was incorporated in Charleston for the development of a greater museum. To this new body the Library Society, in 1815, generously transferred the museum, thus undoubtedly making possible a larger development than could have been expected of a subsidiary activity of the library.

In 1815 the state legislature and the city council "with a promptness and liberality which will forever redound to the credit,"[3] as the old record runs, made appropriations for the purchase of the extensive collections of Dr. Felix l'Herminier, who became the superintendent of the museum. This is the first record that I have found of the appropriation of money by a state legislature or a city council to any American museum.

During the next ten years the museum grew rapidly and acquired an astonishing popularity. In 1824 an editorial in the *Courier* says: "In these enlightened times, a public museum is as necessary an appendage to a city as a public newspaper or a public library."[4]

In 1826 the museum was "open every day from 9 o'clock and brilliantly illuminated every evening."[5] I think this period was one of the high spots in museum history.

In 1827, however, a movement to erect a building having failed, the Literary and Philosophical Society deposited the Museum with the new Medical College of the State of South

[3] Shecut, J. L. E. W., Medical and Philosophical Essays, Charleston, 1819.

[4] The *Courier*, November 23, 1824.

[5] The *City Gazette*, most of the issues of January, 1826. An advt.

Carolina, under whose auspices it was developed for more than twenty years.

In 1850 the American Association for the Advancement of Science held its third meeting in Charleston, and at the session of March 16, Louis Agassiz suggested the desirability of establishing a larger museum in Charleston about the nucleus of the museum of the Literary and Philosophical Society. This is apparently Agassiz's first effort in museum development and is particularly interesting as a prelude to his great work for the Museum of Comparative Zoology at Cambridge.

Interest developed rapidly and at a meeting of the board of trustees of the College of Charleston on March 28 (almost exactly the seventy-seventh anniversary of the founding of the museum) a proposal was favorably received looking to the use of rooms in the College of Charleston for the museum. This plan was formally approved by the trustees on July 15, 1850, and was communicated to the city council for endorsement, since the city was expected to defray the maintenance of the museum. The minutes of city council were destroyed during the Civil War, but the communication of the trustees of the college fortunately was printed in the Charleston *Courier* of July 19, 1850, and contains the following indications of the plans for the museum:

> The yearly regular expenses therefore may be estimated at about fifteen hundred dollars and it is believed that at present that amount can not be raised by private subscription and, under existing circumstances, could only be permanently provided by an annual appropriation by the city. It is confidently believed that such an appropriation would be amply compensated by the advantages which a well regulated and well sustained museum would bring to the city. It would aid greatly in exciting and rewarding a spirit of research and accurate inquiry among all our students of natural history. It would furnish us with new and accurate information of the changes which have taken place in the different accessible strata of our state and of the inhabitants in all departments of nature, by which these strata have been successfully occupied. It would assist the agriculturalist in studying the nature of his soil and suggest the means of stimulating its fertility.
>
> It would bring us into direct relations with the distinguished naturalists of this country and of Europe and be a point of attraction to them under favorable auspices and, maintained with that zeal and ability which it would surely deserve, it would be an ornament and an honor to the city and to the state.

The application of the trustees was favorably received by city council and on August 28, 1850, an "Ordinance to provide for the appointment of a curator for the museum of the College of Charleston"[6] was duly ratified.

The City of Charleston was thus the first municipality in America to enter into a permanent supporting relation to a museum. It has faithfully maintained that relation to the present time. Charleston's example has been widely followed by other cities, notably New York, and the principle is now recognized as an exemplary one.

Surviving the war between the states, the museum continued to grow through the devotion of its curators. It was, however, too much an adjunct of the college to fill the rapidly growing functions of a public museum in the early years of the present century.

The city council responded to a new program for the museum with a generosity and appreciation in keeping with its tradition, increased its appropriations, and in 1907 provided the present building.

In March, 1915, the Charleston Museum was incorporated in the one hundred forty-second year of its age. The city reaffirmed its partnership. The work of the museum was expanded and the interest of the people broadened and deepened. In 1919 Mr. William M. Bird, a trustee, bequeathed the nucleus of an endowment and the County of Charleston became a new partner, levying a one-quarter mill tax for the benefit of the museum.

The history of America's first museum is filled with originality, perseverance, vigor and high promise. The museum holds a conspicuous place in the life of Charleston. Under the able leadership of the director its attendance in 1922 was over 50,000. In a city of only 35,000 white population this is a record probably never before equalled.

Parallel with this development of the Charleston Museum there is a complex history of museums in other parts of the United States. We may appropriately sketch the outline of

[6] The *Courier*, August 31, 1850.

this broader movement as a background for the vision that must fill our minds of the future of museums.

I have referred to the Charleston Museum as the first expression of the museum idea. It does not seem probable that it was the pattern of the museums which sprang up in other parts of the country. Rather, we must conceive of the idea as developing more or less independently and under somewhat different auspices in widely scattered places. The second American museum was the Peale Museum of Philadelphia. Since this had but a brief history we need not dwell upon it. The second oldest museum in existence is the East India Marine Society Museum, now a part of the Peabody Museum at Salem, Massachusetts. This was founded in 1799 as a repository for the curiosities gathered by ship captains of Salem from distant parts of the world.

The first half of the Nineteenth Century gave rise to a number of museums in connection with both learned societies and colleges. Among those may be mentioned the Pennsylvania Academy of Fine Art, (1805), Bowdoin College Art Museum (1811), Academy of Natural Sciences of Philadelphia (1812), Allegheny College Museum (1820), Boston Society of Natural History (1830), Wesleyan College Museum (1831), and the Portland Society of Natural History (1843). The beginning of the National Museum in 1846 marks the culmination in the museum development of the period.

The founding of science museums by colleges and learned societies was a natural expression of the interest of the time in descriptive natural history. The displacement of that interest by the biology of the succeeding half-century, with its emphasis upon laboratory study of morphology and embryology, is the fundamental reason for the large number of neglected and inactive college museums to-day. It is essential that we recognize that these museums filled a vital place in the life of their time. Their deterioration was the result of fundamentally changed conditions. They are largely responsible for the widespread popular concept of museums as static and somewhat dreary things. One of the tasks in which we are making progress is that of changing this concept in the minds of the people.

The greatest and most active museums of America to-day, with few exceptions, have originated within the past fifty years and have had their phenomenal development within twenty-five years. A few examples may be given: American Museum of Natural History (1869); Metropolitan Museum of Art (1870); Museum of Fine Arts, Boston, (1870); New York State Museum (1870); Pennsylvania Museum (1876); Art Institute of Chicago (1879); Milwaukee Public Museums (1882); Brooklyn Institute of Arts and Sciences (1889); Field Museum of Natural History (1894); Worcester Art Museum (1896); John Herron Art Institute (1896); Carnegie Institute Museums (1896). Most of these museums are of a new type, being founded and supported either by private endowments or by municipal or state funds. There is a marked decrease in the number of new museums founded by colleges or by technical societies and museums are henceforth significant as public institutions.

The conception of museums as store-houses and research organizations, of interest principally to specialists, has been broadened to give equal importance to the interpretation of their subject matter to the public. This is the most significant advance in museum purposes and methods during the whole hundred and fifty years of museum history. It is making museums popular universities in a field of apparently endless possibilities.

SUMMARY

The Charleston Museum was the first museum in America. It was the first to take many of the most significant steps in the evolution of the museum idea. The same idea germinated, more or less independently, and expressed itself in somewhat different ways in other places. Four sources of support have been widely used: (1) learned societies; (2) schools, colleges and universities; (3) private endowments; (4) municipal, state or national funds. The first of these leads to museums of high technical value but not to the broader museum functions. The second is responsible for the largest number of existing museums, but this group functioned most fully during the Nineteenth Century and is to-day in a period of decline or eclipse. The third is the foundation of some of the largest and most influential

modern museums, but does not enlist the full support of the people if the endowment is drawn from a single individual. The fourth is a reasonably satisfactory source, but subject to the usual weaknesses of government activities. The most successful foundation for the modern museum, broadly speaking, seems to be the combination of private endowments from many sources for the creation of the museum and municipal support for its operating expenses—the Charleston plan.

About fifty per cent. of American museums are devoted exclusively, or chiefly, to natural history; about twenty-five per cent. to history, and about ten per cent. to art. Approximately thirty-eight per cent. of these museums derive their financial support from schools, colleges and universities; thirty-five per cent. from societies or associations; fifteen per cent. from city governments; seven per cent. from private individuals or endowments exclusively; four per cent. from state government, and one per cent. from the national government.

These statistics do not indicate the relative importance at the present time of the subjects treated by museums, or the importance attached to museums by the various organizations that support them. It is not those museums that reflect past conditions, but those that hold promise of future service that are most significant. The half century in which we live may be confidently expected to see the expansion of the museum ideas that germinated during the second half of the Nineteenth Century. It should be our goal and our determination to secure national recognition of the sentiment expressed ninety-nine years ago in the editorial in the Charleston *Courier*, previously quoted: "A public museum is as necessary an appendage to a city as a public newspaper or a public library."

PAUL M. REA
CLEVELAND MUSEUM OF NATURAL HISTORY

FIELD EXPLORATIONS OF THE AMERICAN MUSEUM DURING THE YEAR 1922

THE American Museum of Natural History, deeply concerned with the rapid disappearance of the natural life and beauty of the world, among both the native races of men and the mammals of land and sea, is pushing exploration very hard at the present time, especially in Africa, Australia, southern and northern Asia and Polynesia. In the fifty-fourth annual report, issued May first, there is set forth a statement and summary of the scientific achievements and expenditures of the museum during the year 1922 which is recast in condensed form for the readers of SCIENCE.

These expeditions of 1922 represent an expenditure of more than a half million dollars for purely scientific work and about a half million for the extension of the results to educational institutions of the city and country; they represent 194,475 miles of travel during the single year; above all, they represent devotion and self-sacrifice in the interests of the museum on the part of the explorers and collectors which are beyond all praise. The work was made possible through extreme generosity on the part of members and friends of the museum, who in some instances financed the entire cost of an expedition and in others supplemented the funds of the museum which are devoted to this work.

The Third Asiatic Expedition, now in its third year, started in the spring of 1921 under the leadership of Roy Chapman Andrews, and results obtained thus far have exceeded expectations. In April of 1922 the expedition left Kalgan for Mongolia to continue work in zoology, geology, paleontology and geography as far as Urga, westward to the eastern extension of the Altai and Tian Shan Mountains and south to the frontier of Chinese Turkestan, a region including the most arid section of the Gobi Desert and rolling meadow-lands and foothills at the base of high mountains, some of which are covered with perpetual snow. On the way to Urga, about 260 miles northwest of Kalgan, fossil remains comparable to fossils found in Wyoming were unearthed—an epoch-making discovery because it throws light on the migration of animal life from Europe to America *via* Asia. While the fossil hunters were studying these beds, leader Andrews and the zoological branch pushed on to Urga and completed arrangements for the journey west of Urga into the region which was to occupy them for the summer.

In India two parties are enthusiastically

making collections of great value for the museum; in the historic fossil-bearing formation of the Siwalik Hills Barnum Brown, under great difficulties, has secured fossil material, including mastodon and elephant skulls, of such importance as to raise the museum collection to the third position in this respect in the world. In the southwest the big game animals are being hunted for the museum by Colonel J. C. Faunthorpe, an A. D. C. to King George and a resident commissioner at Lucknow, and Mr. Arthur S. Vernay, who are responsible for the Faunthorpe Indian Expedition. The museum has provided a taxidermist, John Jonas, of Montana, and will defray the expense of transporting the material collected.

Carl E. Akeley's fourth expedition to Africa, from which he returned in March of 1922, yielded five specimens of gorillas of the Kivu country, the largest weighing 360 pounds, which will be mounted in a habitat group for the African Hall. James L. Clark, with Kenyon V. Painter, visited the Tanganyika country to procure material for a rhinoceros group, and R. T. Burge, of Los Angeles, is also expecting to collect for the museum on his present trip to Africa and India.

Extensive exchanges with various museums in Australia are enriching the museum collections through relations established by William K. Gregory during his visit to Australia. Among such material are a collection of skulls of Australian aborigines, a cast of the skeleton of the marsupial elephant *Diprotodon* and a rare nectar-eating phalanger *Tarsipes*. The field collecting was continued by Harry C. Raven, who with the cordial cooperation of government officials and museum and university men secured a representative collection of Australian mammals—kangaroos, wallabies, native bear, etc. Mr. Raven also collected mammals and marine birds in Tasmania..

During the year N. C. Nelson spent several months in western Europe studying prehistoric collections in the museums and in private hands and collecting material of the Paleolithic period. He also visited a number of new archeological sites in England, France and Belgium, making some excavations. Through previous journeys of Mr. Nelson, three journeys of President Osborn and one of Dr. McGregor, beginning in 1913, the museum has secured splendid collections of the archeology and prehistory of man in Europe, which will be displayed in the Hall of the Age of Man and the Hall of the Prehistory of Man.

The museum is hunting in Württemberg for the ancestors of the dinosaurs; in southern Württemberg Dr. F. von Huene is excavating for fossils at Trossingen and his results will be shared jointly by the Tubingen Museum and the American Museum.

Through field work conducted in the Azores and the Cape Verde Islands by José G. Correia the museum bird collections are enriched by several hundred specimens, particularly marine birds, including petrels, boobies, tropic birds and some of the rare insular species of land birds. The bird collections also continue to benefit by the Whitney South Sea Expedition in Polynesia, under the leadership of Rollo H. Beck. In the two years that the expedition has been in the field 3,851 specimens have been collected, nearly all new to the museum collections and many new to science, with 562 photographs and extensive field notes.

Southern Alaska was visited by P. E. Goddard, accompanied by Lieutenant G. T. Emmons and Dr. C. F. Newcombe of Victoria, B. C., for the purpose of collecting Indian totem poles and wood carvings for the Jesup Hall and for obtaining first-hand information for a handbook on the tribes of that region. A number of interesting specimens were secured.

South America contributed largely during the year to the museum collections and information. Herbert Lang made an extensive study of the fauna of British Guiana and later went up the Mazaruni River as far inland as Mount Roraima, making comparisons between the South American forests and savannahs and those of Africa, which he had previously studied. G. H. H. Tate and Herbert E. Wickenheiser collected mammals in Ecuador, where also Messrs. Chapman, Cherrie and O'Connell made a successful reconnaissance of the coast and mountains, collecting several species new to science and about a dozen not hitherto recorded from this locality. About six hundred specimens were collected and arrangements were made with native collectors to secure other birds from little-known parts of eastern Ecua-

dor. The biological survey of Amazonian waters was continued by Harry Watkins in Peru, while Ernest Holt collected birds in the mountains of eastern Brazil.

G. K. Noble spent three months in Santo Domingo collecting reptiles and amphibians and studying their life histories. He secured several thousand specimens, including nine new species. He observed the life histories of many species and procured specimens and material for habitat groups of the largest tree frog in the world and the largest lizard in the Americas.

Within the United States geological studies were carried on by E. O. Hovey in Colorado, California and Oregon; by C. A. Reeds in New York state; and by E. A. Foyles in the Lake Champlain region. A reconnaissance trip during the summer was conducted through northwestern Nebraska southward to Pawnee Buttes by W. D. Matthew and Childs Frick, who observed chiefly the stratigraphy of these formations and secured a few specimens of rare fossil animals. A valuable collection of fossil mammals was secured by Albert Thomson near Agate, Nebraska; Messrs. Olsen and Miller collected fossils in the Bridger formation of Wyoming; Messrs. Mook and Kaisen worked in the Cretaceous of New Mexico, from which they obtained a new type of Horned Dinosaur discovered by Charles H. Sternberg. Valuable exchanges were arranged with the Colorado Museum of Natural History, and through the visit of Charles Lang to the museum of the University of California material to complete a mounted skeleton of the Giant Ground Sloth *Mylodon* from the Rancho La Brea deposits was secured.

Roy W. Miner, in cooperation with Frank J. Myers, continued his field studies in southern New Jersey in connection with the new Rotifer group, which will show the animals and plants of a half-inch portion of pond bottom magnified to an area five feet square. F. E. Lutz spent the summer near Boulder, Colorado, continuing the field work which he has been doing in connection with the wild bees of Colorado and carrying on investigations as chairman of the National Research Council committee on the biological relations between flowers and insects. Seven species, two new to science, were added to the list of about eight hundred different kinds of wild bees in Colorado. Through the generous cooperation of B. Preston Clark, Frank E. Watson collected about 11,000 specimens of insects, lower invertebrates, fishes and reptiles in Haiti and also enriched the museum exhibition and study series of insects by field work near New York City.

Work on the anthropology of the Southwest, which was commenced in 1909, was continued by Earl H. Morris, especially in Aztec, New Mexico. This work has followed exploration of the Pueblo Bonito through the gift of Mr. Frederick E. Hyde and Mr. B. T. B. Hyde, the results of which were published in 1920 in the volume on the Pueblo Bonito and furnish important data for comparative study of these cultures. This work has yielded results of great interest and the ruins have proved in many ways the most complete record of the past history of this region. It was early decided not to destroy these ruins but to preserve them and the excavation was carried on with utmost care, preservation proceeding step by step with the digging. As a result, the museum was able to present this monument of Aztec to the United States, in the name of Archer M. Huntington. Clark Wissler examined some archeological sites in New York State along the Hudson, where evidences of prehistoric occupation were discovered and some curious stone works uncovered. Arrangements have been made for more extensive excavation. Earl H. Morris, accompanied by Charles L. Bernheimer, explored part of southern Utah, located a number of heretofore unknown prehistoric ruins there which will be thoroughly examined in the near future and made a general reconnaissance of the Navajo Mountain region of New Mexico.

HENRY FAIRFIELD OSBORN
AMERICAN MUSEUM OF NATURAL HISTORY
MAY 29, 1923

THE EDWARD K. DUNHAM LECTURESHIP FOR THE PROMOTION OF MEDICAL SCIENCE

EDWARD KELLOGG DUNHAM died on April 15, 1922. He was a pathologist and bacteriologist whose training, as subsequent events were to show, was much in advance of his period.

Profiting in an unusual degree from his undergraduate studies at the School of Mines of Columbia University, he carried with him, first to the Harvard Medical School and later into his teaching and research, a proficiency in the fundamental sciences of mathematics, chemistry and physics possessed by few of his contemporaries.

The Edward K. Dunham lectureship has been established at Harvard University by his wife, Mary Dows Dunham, through a gift of $50,000 in conformity with the following provisions:

It would be my hope, that in addition to other useful purposes, this Foundation would serve to bind closer the bonds of fellowship and understanding between students and investigators in this and foreign countries.

The lecturers chosen under this Foundation should be eminent investigators and teachers in one of the branches of the medical sciences, or of the basic sciences which contribute towards the advance of medical science in the broadest sense.

While I assume that the lecturers may be expected to be drawn chiefly from among the leaders of foreign medical research, it is my desire that the lectureship be open also to persons eminent in their respective subjects residing within the United States.

The selection of the lecturers shall be determined by a suitable committee of the Harvard Medical School, of which the Dean of the Medical School is a member, the other members being chosen from departments of pathology, physiology, bacteriology, biochemistry and medicine, or their future equivalents.

The lectures shall be given annually. The income of the fund is to be used in defraying the expenses of the lecturer and for an honorarium for the lectures.

In the event of the lectures given under the Foundation being published, it is my wish that they carry a suitable inscription indicating that they were delivered under the Edward K. Dunham lectureship of Harvard University.

The lectures are to be free and open to the faculty and students of the Harvard Medical School and College, and all other interested professional persons who may profit by them.

Of Dr. Dunham himself it may be said that the basic training which he enjoyed determined in a large measure the nature of his profounder interests and the character of his individual pursuits in pathology and bacteriology, subjects which he elected as his life's work.

The first fruits almost of his unusual preparation in chemistry came while he was still studying bacteriology in Koch's laboratory in Berlin, where he discovered the well-known "Cholera-red" reaction which has played and still plays a large and important part, not only in the identification of bacterial types, but also in the determination of their metabolic activities. It is again to be detected in his studies of the lipoids occurring in glandular organs, which he pursued actively for several years and at a period when their fundamental significance had not yet come to be appreciated.

While Dr. Dunham was a persistent student and investigator, he was not a prolific writer. This is a circumstance much to be regretted because it tended too much to limit the knowledge of his work and his pregnant points of view which he shared freely with his associates and intimate friends. It was he, for example, who discovered the spore-bearing propensity of the *Bacillus aerogenes capsulatus* or, as commonly called, the gas bacillus of Welch. This discovery revealed an important event in the life history of the bacillus and the large group of affiliated micro-organisms. But it did more than this, since it provided a new method of wide application. The discovery, moreover, was not accidental but arose out of a well-considered plan of study of the conditions—chemical and physical—surrounding the manner of growth, survival, etc., of the Welch bacillus. Likewise his studies of the meningococcus, undertaken while a member of the Board of Health Commission created during the epidemic of meningitis which prevailed severely during a decade beginning about 1904, had as their object not so much the identification of that micro-organism through its cultural characteristics as through its chemical effects. He determined the limits of its fermentative power over a wide range of carbohydrates and thus was enabled to bring about its separation from certain other diplococci with which confusion easily occurs.

This bias toward the more exact or mathematical, chemical and physical aspects of bacteriology and pathology is evident in all Dr. Dunham's investigations and appeared constantly in his expressed opinions on scientific questions. Its possession enabled him easily

and in an altogther remarkable degree to turn from one kind of scientific pursuit to another and afforded him a versatility and a resource in experiment and in action which few enjoy. He became, through this circumstance and by virtue of an unfailing and exceptionally sympathetic nature and manner, a dispenser of knowledge and help to an ever-widening circle of scientific workers who drew freely on his rare stores of information and wisdom.

The great war engaged profoundly his emotions and his scientific faculties. He at once threw himself into those activities in which he was qualified to render service. No duty, no demand to aid was too severe for him to undertake with the full extent of his powers. His services on the "Empyema Commission," created by the Surgeon-General, and of which he was made chairman, were numerous and invaluable. No one could have devoted himself more unsparingly, more unselfishly and more skillfully to the unravelling of the intricate problems which arose or brought to their consideration so many and varied scientific resources. He approached the problem as pathologist, bacteriologist and chemist and later and in due course of events, as would the surgeon and therapeutist as well. This great undertaking, ramifying as it did along almost endless lines of causation, prevention, treatment, immediate and end results, claimed his last days and too often his last nights also, and preoccupied and absorbed him to an extreme degree. Fortunately, the manuscript covering this study has been brought almost to conclusion. That its publication will reflect credit on his efforts and honor on American medicine is the conviction of all who knew the nature and the extent of Dr. Dunham's labors.

Dr. Dunham was for many years professor of pathology in the Bellevue and University Medical College of New York City. On relinquishing this connection, a few years before his death, he became emeritus professor, continuing active by giving occasional lectures and in divers ways promoting the work of the college.

SIMON FLEXNER

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH
NEW YORK CITY

SCIENTIFIC EVENTS

MEMORIAL TO SHACKLETON

THE following statement has been made public in England:

At a meeting held at the Mansion House on May 8 a committee was constituted with the object of promoting a national memorial to Sir Ernest Shackleton.

The voyages which he planned in the Nimrod, the Endurance and the Quest covered almost every side of Antarctic exploration. The history of the first two expeditions is the story, on the one hand, of originality and resourcefulness carrying him far beyond his predecessors, and on the other, of apparent failure triumphantly retrieved. In spite of the colossal risks undertaken, and the disasters faced and overcome, every man who sailed under Shackleton's direct command on either of these expeditions to the Antarctic was brought safely back; and had Shackleton lived to carry out the program of the Quest a new chapter in the history of the exploration of the Southern Seas might well have been the result.

We feel strongly that, in the case of one who displayed such brilliant qualities of courage and leadership, it is a national duty that his memory should be perpetuated by some suitable memorial of a permanent nature, so that his example should be forever an incentive to the youth of the Empire.

For this object we anticipate wide sympathy and support; but there is another basis for our appeal. It is known that Sir Ernest Shackleton was a successful lecturer, and that he received large sums for film rights and for his books, but the money he obtained from these sources was never sufficient to meet the obligations he had himself incurred in endeavoring to complete the finance of his various expeditions. The Endurance expedition, though providing probably the greatest feat of successful leadership in the history of exploration, left Shackleton heavily in debt at a time when his sole thought, directly he returned, was to participate in the Great War.

The second object, therefore, for which we appeal for funds is to provide for the education of his children, and to take his place in supporting his mother. The balance that remains, after meeting these two obligations, will be devoted to the encouragement of exploration.

Checks for donations may be made payable to the National Provincial and Union Bank of England, Limited, for credit of "Shackleton Memorial Fund," and may be paid into any branch of that bank, or may be sent direct to the honorary

treasurer, Mr. Howard Button, C.B.E., Messrs. Chantrey, Button, and Co., 61-62, Lincoln's Inn-fields, London, W.C.2.

Yours truly,

CURZON OF KEDLESTON	JOHN Q. ROWETT
INVERNAIRN	CHARLES SAROLEA
EDWARD C. MOORE, Lord Mayor	J. SCOTT KELTIE
F. BECKER	A. E. SHIPLEY
PHILIP L. BROCKLEHURST	GEORGE SMITH
MARTIN CONWAY	JANET STANCOMB-WILLS
ROBERT DONALD	FRANK WILD
E. R. G. R. EVANS	A. F. YARROW
RUPERT GWYNNE	HOWARD BUTTON, Hon. Treasurer.
ALFRED HUTCHISON	KENNETH M. CHANCE, Hon. Sec.
F. C. LEARMONTH	J. M. WORDIE, Hon. Sec.
G. S. LYSAGHT	RONALDSHAY, President
CHARLES MAYNARD	
HUGH ROBERT MILL	
RALPH RICHARDSON	

LONDON, MAY 24, 1923

THE BEQUESTS OF DR. LUDWIG MOND[1]

BY the death of Mrs. Mond, widow of Dr. Ludwig Mond, which occurred on May 16, the Royal Society becomes the beneficiary, under Dr. Mond's will, of a considerable sum of money in furtherance of scientific objects. Dr. Mond, as is well known, was a distinguished chemical technologist. He worked under Kolbe at Marburg, later under Bunsen at Heidelberg, finally becoming domiciled in England, where he secured the friendship of the leaders of British science, as also of many persons in literary and artistic circles. He was elected a fellow of the Royal Society in 1891, and died in 1909. The provisions of his will relating to gifts to science provided for the payment to the Royal Society, free of duty, of 50,000*l*, the income to be employed in the endowment of research in natural science, more particularly, but not exclusively, in chemistry and physics, by means of rewards for new discoveries and pecuniary assistance (including scholarships) to those pursuing scientific investigations, and in supplying apparatus and appliances for laboratories and observatories and in such other manner as the Royal Society should decide to be best calculated to promote scientific research. There was also a proviso that the Royal Society's council might allocate amounts for the publication and circulation of reports and papers communicated and assist the preparation and publication of catalogs and indexes of scientific literature which the society might have engaged in or might undertake in the future. To the University of Heidelberg a like sum was left, and for kindred purposes. Certain financial contingencies entailed that four years might elapse after Mrs. Mond's decease before these two bodies entered upon absolute ownership; notwithstanding, the legacies were to carry four per cent. interest per annum until paid up. It may be recalled that at the Royal Society's anniversary meeting of 1910 the then president referred to Dr. Mond in the following terms:

> The Royal Society has good cause to cherish his memory as that of a genial fellow, who took an active interest in its affairs, affording it at all times the benefit of his business experience, and ever ready to aid financially any of its enterprises which seemed to him to stand in need of assistance. By his will also he has left a munificent benefaction whereby the society will ultimately be enriched.

[1] From *Nature*.

ZOOLOGICAL LECTURES AT THE UNIVERSITY OF MICHIGAN

A SERIES of zoological lectures was arranged for the second semester at the University of Michigan. The primary purpose of the series was to provide, for advanced students of zoology, an outlook on the whole field that could not be gained in any other way. To this end the speakers were invited to discuss in a semi-technical fashion the large aspects of biology in which they were most directly interested. The lectures proved admirably fitted for this purpose and were well attended by students and members of the faculty representing not only the other sciences but the humanities as well. The list of lectures and their topics follows:

Geological history of the mammals: W. D. MATTHEW.

The blood as a physico-chemical system: L. J. HENDERSON.

Adaptations of insects; economic aspects of entomology: L. O. HOWARD.

Modifications of developmental rate and the structural response: C. R. STOCKARD.

The oestrous cycle as a means of analyzing structural change: C. R. STOCKARD.

Some of the recent work on mutants in drosophila; Development and the particulate theory of inheritance: T. H. MORGAN.

Genetic problems in the protozoa; Crossing-over: H. S. JENNINGS.

Experimental study of longevity. I. Environmental factors. II. Inheritance: RAYMOND PEARL.

The neuromotor system of protozoa; The life cycle of protozoa with reference to certain fundamental aspects of evolution: C. A. KOFOID.

The genetic foundation and the balanced character of sex; The limits of action of sex hormones: F. R. LILLIE.

The chromosomes in relation to the individual; The chromosomes in relation to the race: C. E. MCCLUNG.

Physical and chemical characteristics of lake waters; The biology of lakes: CHANCEY JUDAY.

As a secondary function, the series served to introduce important phases of biology to the general public. A special group of evening lectures, semi-popular in their nature, was arranged. That these non-technical lectures fulfilled their purpose was evidenced by the interest aroused on every hand. The speakers and their subjects in this semi-popular series were as follows:

Dinosaurs: W. D. MATTHEW.

The fitness of the environment: L. J. HENDERSON.

The warfare against insects: L. O. HOWARD.

The origin of human types and the influence of internal secretions: C. R. STOCKARD.

Genetics and development: T. H. MORGAN.

Can we observe evolution in progress? H. S. JENNINGS.

The problem of population growth: RAYMOND PEARL.

Amoeba and man: C. A. KOFOID.

The unity of life: C. E. MCCLUNG.

The productivity of lakes: CHANCEY JUDAY.

FIELD EXCURSION OF OHIO GEOLOGISTS

THE geological section of the Ohio Academy of Science held its annual field excursion on May 25, 26 and 27, in Muskingum County, Ohio. The party assembled at Newark at noon on the twenty-fifth and that afternoon was devoted largely to archeology as shown by earthworks near Newark and the great flint quarries on Flint Ridge. Dr. W. C. Mills, director of the Archeological and Historical Society of Ohio, was the guide for this part of the trip.

The geological excursion proper was on the twenty-sixth and twenty-seventh and Mr. Wilber Stout, author of Bulletin 21, Geological Survey of Ohio, on the Geology of Muskingum County, was the guide during these two days. The rocks studied include the entire Pennsylvanian system and the basal fifty feet of the Permian and more than thirty of the named members of the Ohio geological column were seen. In addition certain Quaternary deposits used as molding sands were examined and some very interesting topography involving several erosion cycles was seen.

Fifty people were present on the afternoon of May 25 and about thirty-five on the twenty-sixth and twenty-seventh. The organizations represented include the Geological Survey of Ohio, the Soil Survey of Ohio, the Ohio State University, Western Reserve University, Denison University, Miami University, Antioch College, Muskingum College, the Dayton High School, the University of Michigan, the University of West Virginia. The trip was made by automobiles and was under the management of Dr. J. Ernest Carman, Ohio State University, vice-president for geology of the Ohio Academy of Science.

THE PACIFIC DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

DR. E. P. LEWIS, professor of physics in the University of California, has been elected president of the Pacific Division of the American Association for the Advancement of Science, *vice* Dr. E. C. Franklin, resigned, whose duties as president of the American Chemical Society precluded his serving at the Los Angeles meeting in September. President Lewis will preside at the Los Angeles meeting and deliver an address, the subject of which will be announced later.

The general sessions at Los Angeles will open with a research conference on Monday, September 17, during the luncheon hour, which will be prolonged to permit reports from the Riverside Citrus Experiment Station, the Scripps Institution for Biological Research, the California Institute of Technology and the University of Southern California. General discussion will follow the presentation of reports.

President Lewis's address will occur at a public reception to be held Monday evening, September 17, in Bovard Auditorium, University of Southern California.

An interesting feature of the general sessions will be a symposium on eclipses and relativity, in which noted astronomers and physicists will participate. The preliminary announcement giving further details of the arrangements will be issued about June 15.

SCIENTIFIC NOTES AND NEWS

DR. GEORGE CRILE, of the Western Reserve University Medical School, was elected president of the American Surgical Association at the recent Cleveland meeting.

DR. HARVEY W. WILEY, president of the United States Pharmacopeial Convention 1910-1920, has been elected an honorary member of the Pharmaceutical Society of Great Britain. This society, like the United States Pharmacopeial Convention, is charged with the duty of keeping the pharmacopeia up to date.

SECRETARY OF WAR WEEKS has announced the award of the Distinguished Service Medal to C. H. MacDowell, for service as head of the chemical branch of the War Industries Board during the war. Mr. MacDowell is now president of the Armour Fertilizer Works, Chicago.

WE learn from *Nature* that Professor L. Cayeux, Paris; Professor John M. Clarke, director of the New York State Museum; Professor H. Douvillé, Paris; and Professor Waldemar Lindgren, Massachusetts Institute of Technology, have been elected foreign members of the Geological Society, London. Among the foreign correspondents elected are Professor R. A. Daly, Harvard University; Professor J. F. Kemp, Columbia University; and Dr. F. E. Wright, Geophysical Laboratory of the Carnegie Institution.

MR. A. F. BASSET HULL has been elected president of the Linnean Society of New South Wales. J. P. Hill, professor of zoology and comparative anatomy in the University of London, and J. T. Wilson, professor of anatomy in the University of Cambridge, formerly professor in the University of Sydney, have been elected honorary members of the society.

PROFESSOR FRANK S. CAREY, of the University of Liverpool, retires at the end of the academic year after thirty-seven years' service as professor of mathematics.

AT the annual meeting of the New Haven Branch of the American Society of Mechanical Engineers on May 21 tribute was paid to Professor L. P. Breckenridge, of Yale University, who retires this year from active teaching, after forty years of service. Professor Breckenridge addressed the meeting on "The past and future of engineering." Fred J. Miller, past president of the American Society of Mechanical Engineers, presented Professor Breckenridge with an illuminated testimonial signed by all the members of the New Haven Branch. A binocular microscope, the gift of all the members of the mechanical-engineering department of Yale University, was presented to him at luncheon earlier in the day.

DR. CHARLES I. ROBINSON, chief chemist in the research laboratory of the Bayway refinery of the Standard Oil Company, at Elizabeth, N. J., retired on May 5, after thirty-seven years of continuous service and will receive an annuity. A dinner in his honor was given by his associates on May 9.

AFTER twenty-six years of service with the Solvay Process and Semet-Solvay Companies, Syracuse, New York, Alexis C. Houghton has resigned his position as chief chemist, to enter the employ of the Bakelite Company, New York City, where he will have charge of the phenol plant.

MR. M. AUROUSSEAU, petrologist at the geophysical laboratory of the Carnegie Institution of Washington, resigned on May 15 to join the scientific staff of the American Geographical Society, New York City.

DR. L. O. HOWARD, chief of the Bureau of Entomology of the United States Department of Agriculture, is in Europe attending the meeting at Paris of the Eleventh International Congress of Agriculture, of which he has been elected a vice-president.

DR. P. I. WOLD, professor of physics at Union College, has accepted an invitation from the Rockefeller Foundation to spend a year as visiting professor of physics in China on behalf of the China Medical Board. Dr. and Mrs. Wold will leave this country about the middle of July and will have their headquarters in Tientsin.

DR. A. C. SPENCER has been granted leave of absence for a month from the United States Geological Survey to do professional work in Cuba.

MR. K. C. HEALD, geologist, of the United States Geological Survey, is on leave of absence for several months to give a course of lectures on petroleum geology at the University of Chicago.

PROFESSOR MADISON BENTLEY, head of the department of psychology at the University of Illinois, is lecturing upon psychology during the intersession of the summer session of the University of California. He is spending a year's leave of absence from Illinois in research and writing at the University of California.

DR. MORTIMER E. COOLEY, dean of the Colleges of Engineering and Architecture, University of Michigan, and president of the Federated American Engineering Societies, delivered the commencement address at the Armour Institute of Technology on May 31. His subject was "The responsibility of education." On this occasion Dr. Cooley was given the honorary degree of Doctor of Science.

JOHN LYLE HARRINGTON, president of the American Society of Mechanical Engineers, delivered a series of five lectures at the University of Texas from May 21 to 24. Mr. Harrington's subjects were: "The relation of the engineer to America's further development," "The part of the engineer in the advance of civilization," "Movable bridges," "The design of industrial plants" and "After graduation what?"

DR. CHARLES ZELENY, of the University of Illniois, lectured at the University of Kentucky before the Kentucky Chapter of the Society of the Sigma Xi on May 25, on "Some phases of research on heredity."

AT the annual meeting of the Institute of Physics held in the rooms of the Royal Society on May 30, Sir Joseph Thomson gave the presidential address. He has recently visited the United States and discussed the position of industrial research here in physics.

THE Huxley lecture at the University of Birmingham was delivered on June 7 by Sir Arthur Keith, whose subject was "The origin of the British people."

OXFORD UNIVERSITY has authorized the presentation of an address to the Universities of Paris and Strasbourg on the occasion of the celebration of the centenary of the birth of Louis Pasteur.

A NOVEL feature of the meeting of the British Association at Liverpool, to be held from September 12 to 19, will be a scientific exhibition at which there will be exhibits of apparatus in connection with each section of the association and others showing recent advances in applied science.

AFTER a visit to the Brooklyn Institute of Arts and Sciences on June 2 and seeing the need for extension by Mayor Hylan, it was voted at a meeting of the committee of the whole of the Board of Estimate of New York City to recommend the appropriation of $1,050,000 for the construction of two wings to the buildings. The amount was $100,000 more than the institute had asked for. The committee also recommended, subject to the approval of Aldermanic President Murray Hulbert, who was not present, an appropriation of $86,000 for the construction of a third story on the city aquarium, the amount to include finishing the front of the structure and fireproofing the building.

A LETTER from the State Epidemiological Institute in Warsaw, Poland, announces the establishment of a new medical publication: *Journal of Experimental Medicine*, which will provide a medium for original publications for Polish scientific men, now completely lacking. One thousand subscribers are required, of which number only 240 are available at present. It is hoped that Polish physicians in this country and also libraries will subscribe or help in some suitable way. Those interested should forward their names and addresses to Dr. Casimir Funk, 437 West 59th Street, New York City. Medical publications who have Polish physicians among their subscribers are requested to insert this notice.

THE next meeting of the American Electrochemical Society will be held in Dayton, Ohio, on September 27, 28 and 29, 1923. The plans for this meeting include: A symposium on electrochemistry of gaseous conduction, which is in charge of Dr. Duncan MacRae, research laboratory, Westinghouse Lamp Company, Bloomfield, New Jersey; a symposium on recent

progress in electrolytic refining, Chairman F. R. Pyne, United States Metals Refining Company, Carteret, New Jersey. An innovation at this meeting will consist of round table discussions on the following four subjects: "Electric furnace brass foundry practice," "Organic electrochemistry," "Chlorine," "Electroplating." Trips to local plants will be made.

DR. EDMUND OTIS HOVEY, curator of the department of geology and invertebrate paleontology in the American Museum of Natural History, will sail from Vancouver, B. C., on June 29, for Sydney, Australia, where he will attend the meetings of the second Pan-Pacific Scientific Conference as the representative of the museum. He will also represent the New York Academy of Sciences. The conference is to be held in Melbourne and Sydney from August 13 to September 3. Dr. Hovey will visit various places of geological interest in Australia and on his way back to America will make a tour of the most important geological localities in New Zealand. One purpose of the trip is to obtain information which will be of value in the construction of additional geological relief models at the museum. Another purpose is to establish exchange relations with the museums in New Zealand and to extend those now enjoyed with the museums of Australia.

THE aggregate receipts of the German-Austrian Fund (Graham Lusk, treasurer) amounted to $2660.26, subscribed to by eighty-eight American scientists in sums ranging from $5 to $450. The money was distributed among thirty-three German-Austrian medical laboratories which were designated by the donors in sums ranging between $25 to $300. The account has been closed and has been audited by Dr. Rufus Cole. The following letter is a typical response: "Please accept my most grateful thanks for your most generous gift. Almost daily I think with gratitude of the help which my department has received from America. I am fully aware of the fact that, but for this help, it would have been impossible to continue our classes and scientific investigations."

UNIVERSITY AND EDUCATIONAL NOTES

ANNOUNCEMENT has been made of the merger of the Moore School of Electrical Engineering, provided for in the will of the late Alfred Fitler Moore, and the School of Electrical Engineering of the University of Pennsylvania. The new school will be known as the Moore School of Electrical Engineering and will have the income from a fund of $1,500,000.

DR. WILLIAM D. CUTTER, for the past several years secretary of the New York State Board of Medical Examiners, has resigned to become dean of the New York Postgraduate Medical School and Hospital.

THE following promotions and appointments in the clinical staff of Stanford University School of Medicine, San Francisco, are announced: Dr. William P. R. Clark, professor of medicine in charge of tuberculosis work; Dr. Leo Eloesser, clinical professor of surgery; Dr. Philip K. Gilman, clinical professor; Dr. John A. Bacher, professor of surgery in diseases of the ear, nose and throat; Dr. Harry L. Langnecker, professor of orthopedic surgery and in charge of physiotherapy; Dr. James A. Cutting, clinical professor of medicine to conduct classes in psychiatry.

ASSISTANT PROFESSOR LLOYD L. SMAIL, of the University of Washington, has been appointed to an assistant professorship of mathematics in the University of Oregon.

DR. CARL A. MURCHISON, professor of psychology at Miami University, has been appointed full professor of psychology at Clark University. He will fill the vacancy caused by the resignation of Dr. Kimball Young.

PROFESSOR LEONARD BAIRSTOW has been appointed as from September first next to the Zaharoff chair of aviation tenable at the Imperial College of Science and Technology, London. He has been head of the aeronautical department of the National Physical Laboratory and since 1920 has been professor of aerodynamics at the Imperial College.

DISCUSSION AND CORRESPONDENCE

THE PENNSYLVANIAN OF NORTH CENTRAL TEXAS

WHEN I was at Lota, Chile, I found the federal gendarmerie guarding the property of the Chilean Coal Company—an entirely private

concern—with the zeal displayed by the guards at Potsdam before the all highest fled to Holland, and it was impossible to even look at the dumps without telegraphic permission from the directors in far distant Valparaiso. I suppose the so-called manager would have fainted if permission had been asked to go in the mines.

E. DeGolyer, in a recent number of *Economic Geology*, has made a plea for greater cooperation between economic and other geologists, which is both timely and well put. Companies employing economic geologists, which are to a large extent oil companies, have abundant means for securing the cooperation of most geologists, but the geologist, working upon some special problem, finds it well-nigh impossible to obtain needed information or paleontologic material from the companies, when such help would in no wise affect the company interests.

I could, of course, enumerate several notable exceptions to this generalization and recognize fully the commercial necessity for holding back certain types of information and material, but generally a company will hold data of no present or future value, or even destroy records if they decide to abandon some contemplated development, seemingly actuated by eighteenth century business secrecy, or by the motive that what cost them good money should not be permitted to benefit any one else.

Oil companies are not the only ones imbued with this notion and I know of no more notable example than the Cerro de Pasco Mining Company, which has maintained a corps of geologists for some years and has presumably carried out the only detailed studies of a considerable area in the whole Andes. Much of the information accumulated is of no special value to the company but would be of the greatest importance in stratigraphic and historic geology. For example the fossil plants associated with the company's coal development at Goyllarisquisca would be of the utmost importance in their bearing on plant migrations and the geographic relations between North and South America during the Cretaceous, and yet a letter addressed to their chief geologist on this subject several years ago has never even been acknowledged.

Since its appearance nearly two years ago I have looked in vain for a review or appreciation of Bulletin 2132 of the University of Texas entitled "Stratigraphy of the Pennsylvanian formations of North-central Texas" by Frederick B. Plummer and Raymond C. Moore, having seen but one very brief notice. This work owes its existence to the enlightened policy of the Roxana Petroleum Corporation and it seems to me that their policy can not be commended too highly. Although not qualified to pass an expert opinion on the subject matter, I would like to indicate its general character and the intrinsic evidence of meritorious work that it exhibits.

It comprises a rather full discussion of the stratigraphy of the Pennsylvanian rocks of North Central Texas, an area of approximately 7,000 square miles. These rocks include the formations of the Bend, Strawn, Canyon and Cisco groups with a total thickness of over a mile and the report includes a full account of previous work, local sections, finely executed plates of characteristic fossils and is accompanied by a geologic map of the whole region on a scale of 1/187,500, or approximately three miles to the inch, representing the combined results of all of the Roxana geologists who have worked in the area. There is a chapter on the structure of the Pennsylvania rocks, a summary of the physical history of Pennsylvania time in the region and a summary chapter on correlation, which is discussed at length in connection with the description of the stratigraphic units throughout the body of the work. The report closes with a table showing the distribution of the fauna and a detailed list of fossil localities. The former lists 1 Protozoan, 3 Porifera, 17 Coelenterata, 3 Vermes, 18 Echinoderma, 39 Bryozoa, 94 Brachiopoda, 57 Pelecypoda, 69 Gastropoda, 43 Cephalopoda, 7 Trilobita and 3 Pisces. This enumeration will vouch for the extensive nature of the paleontologic evidence upon which the author's conclusions are based.

The authors dissent from the conclusions of Girty and others that any part of the Bend series is of Mississippian age and correlate it with the Caney and Wapanucka of Oklahoma and the Morrow of Arkansas. Admitting the late Mississippian character of some of the Barnett shale brachiopods and goniatites, the presence of *Fusulina, Leda bellistriata* and the goniatite genera *Glyphioceras* and *Gastrioceras,*

as well as the general stratigraphic and paleogeographic relations, make out a good case for the Pennsylvanian age of these beds.

The work is illustrated by many halftones, sketch maps and diagrams and fully measures up to the highest standards. The authors are to be commended on the excellence of their work which, with the liberal policy of their company already referred to, sets a standard that other companies might well imitate to the lasting advantage of geologic science.

Edward W. Berry
The Johns Hopkins University

THE STATUS OF TEREDO BEACHI AND TEREDO NAVALIS

I have so far refrained from commenting on the efforts of Professor Kofoid and his students to discredit the validity of my *Teredo beachi*. A review in the *Nautilus* for April, 1923, on page 140 of Robert Cunningham Miller's paper on the "Variations in the shell of Teredo navalis in San Francisco Bay," University of California Publication in Zoology, Vol. 22, No. 2, pp. 293-328, bears the following statement which is a slightly abbreviated rendition of Miller's statement on page 25 (317) "The local varieties, including *T. beachi* Bartsch, have not been found sufficiently differentiated to warrant their being classed as subspecies, much less as species."

This, I feel, makes it necessary for me to protest lest my silence be construed as concurrence in the opinion of my West Coast critics.

The paper in question is a beautiful intensive study of *Teredo beachi* Bartsch and, barring the summary, in which the systematic status of this species is discussed, a splendid piece of work. It is unfortunate that the author in question, as well as Professor Kofoid himself, has not made an equally intensive study of the European *Teredo navalis*, which I have been unable to find in American waters, before publishing this summary, for I am certain that had they so done, they themselves would have become acquainted with the characters that differentiate the *navalis* group from the *Teredo morsei* group, to which *Teredo beachi* belongs.

In *Teredo navalis*, the denticles on the anterior median area have but a single cusp. In the *Teredo morsei* group they are multicuspid. That at once differentiates the two groups and there are hosts of other characters that separate the members of these groups into specific or subspecific elements.

The only member of the *navalis* group that I have found so far in American waters is the New England shipworm, *Teredo novangliae* Bartsch. All the other true *Teredos* seen belong to the *morsei* group, both on the east and the west coast of America.

Paul Bartsch
United States National Museum

NICOTINE AS A POULTRY VERMIFUGE

Following the work of Herms and Beach in 1916, the University of California Agricultural Experiment Station has been more or less continuously interested in the use of tobacco and tobacco products as a vermifuge for the intestinal worms of poultry, *Ascaridia galli* Schrank 1788 (= *A. perspicillum*). Work carried on during the past year and a half with hundreds of hens has shown that commercial tobacco dust containing from 1½ to 2 per cent. nicotine if fed in the mash in quantities equalling 2 per cent. by weight of the latter over a period of one month would remove from 98 to 100 per cent. of these worms. The results have also demonstrated that from 80 to 85 per cent. of the cecum worms, *Heterakis gallinæ* Gmelin (=*H. papillosa*, = *H. vesicularis*) are removed by this treatment. The tobacco dust must be mixed with the mash at intervals not exceeding one week on account of the volatility of the nicotine in the presence of air.

Diluted nicotine sulfate administered to the birds directly in quantities sufficient to remove the worms is decidedly toxic. Mixed with the mash or drinking water it renders them so distasteful that the birds will not eat or drink properly. However, by mixing the nicotine sulfate with Lloyd's Alkaloidal Reagent, a selected fuller's earth, perfect elimination of the intestinal worms has been secured, although the cecum worms remained unaffected. The method employed was that of mixing the nicotine sulfate (40 per cent. nicotine) at the rate of 6.6 cc. to 16 grams of the reagent. This mixture was then placed in gelatine capsules (No. 2), one of which when filled weighed

approximately 350 milligrams and constituted a treatment. The Lloyd's reagent holds the nicotine as long as the mixture is in an acid medium, liberating it when it becomes alkaline. The small intestine is slightly acid at its anterior end but becomes rapidly alkaline at about the point where the intestinal worms are present in the greatest numbers. Thus the nicotine is liberated at the desired point for the maximum effect on these worms. Rectal injections of nicotine sulfate (40 per cent. nicotine) diluted at the rate of 1 cc. to 200 cc. of distilled water and administered in 10 cc. injections remove approximately 85 per cent. of the cecum worms. Stronger concentrations are decidedly toxic, a 1 per cent. mixture administered in the same manner causing an immediate paresis and death in about ten minutes.

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TO DEMONSTRATE PROTEIN GRAINS

ONE of the most effective ways to demonstrate the presence of protein grains in the cellular tissue of a seed is by making a free-hand razor section of the meat of a Brazil nut. Place the section on a glass slide, and flood it several times with ether. If enough ether is used to cause it to flow over the edges of the slide the dissolved fat will collect on the under side of the slide where it is easily wiped off. After treating with ether flood with absolute alcohol; replace the alcohol with xylol and mount in xylol, or if a permanent mount is required mount in balsam. The Brazil nut is rich in its peculiar kind of protein, and by this method several of the grains may be seen in nearly every cell.

E. R. SPENCER

AMEBOID BODIES ASSOCIATED WITH HIPPEASTRUM MOSAIC

IN a recent publication[1] the writer described and pictured certain bodies in the cells of corn plants suffering from mosaic disease. Since the bodies are confined to diseased portions of the plant, it was suggested that they might be of etiological significance.

[1] Bul. Exp. Sta., H. S. P. A., 3: 44-58 (1921).

Those who are working on the mosaic disease problem will be interested to know that similar bodies have now been found in the light green portions of mosaic leaves of *Hippeástrum equéstre* Herb. This plant belongs in the Amaryllidaceae and is not closely related to corn. Its leaves which are thick and soft are well suited for cytological studies. The mosaic pattern shown by *Hippeástrum* is quite different from that of corn. The intracellular bodies associated with this disease will be described in detail in a future paper.

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SCIENTIFIC BOOKS

Laboratory Manual of Colloid Chemistry. HARRY N. HOLMES. John Wiley & Sons, Inc. XII + 127 pp.

THIS volume was written at the suggestion of the Colloid Committee of the National Research Council. Colloid chemistry is growing rapidly and this book is a welcome addition to the colloidal literature. There are 186 experiments, from which the student is expected to select the ones suited to his particular needs.

There are first of all methods of preparation and purification followed by illustrative examples of peptization and coagulation, of protective colloids and solvated colloids. The measurement of surface tension and viscosity are treated in brief chapters. In a chapter on adsorption several experiments are given on silica gel. The use of the ultra-microscope receives two pages. Experiments on hydrogen ion concentration and osmotic pressure and Donnan equilibrium are not included. Descriptive matter preliminary to the experiments makes the work easy reading and stimulates the use of the author's bibliography.

In classical chemistry we have used quantitative measurements to the greatest advantage, melting point, boiling point, solubility, percentage composition and molecular weight and they give the firmest sort of a foundation upon which to build a science. Colloid chemistry can hardly be called an exact science until it can offer similar quantitative measurements and

exact definitions. (Too much have we followed the good old practice, "*Wo ein Idee fehlt steckt man ein Wort hinein.*") We have a stupendous nomenclature, but do substances in the colloidal state have a measurable melting point (or something analogous to it)? We say that nitrocellulose is more soluble in acetone than in amyl acetate; but do colloids have a measurable solubility (or some analogous property)? Of what possible use is the measurement of the viscosity of a colloid if the viscosity is always a function of the particular shearing stress used and therefore not a definite property? When do colloidal solutions pass into true solutions? Gels are elastic, but how elastic? And what is a gel? Dr. Holmes quotes, page 43, with approval the interesting statement, "There is a definite connection between the boiling point, the viscosity and the heat of dilution of a solution of salt and its solvent power for cellulose." How is this solvent power measured, what is this connection and why does it exist? Several experiments in this manual are pretty without teaching much. In other cases the lesson is lost because chemists are in disagreement. It seems obvious to the reviewer that there is great need for more fundamental work on colloidal materials. And perhaps it is not too daring to hope that chemists will be found in agreement when the generalizations are sufficiently broad and far-reaching. Such work should serve not only as a basis for sound theory but offer simple quantitative experiments for instructional purposes of the highest pedagogical value.

EUGENE C. BINGHAM

SPECIAL ARTICLES

PHASE REVERSAL IN PROTOPLASM AND EMULSIONS

THE reversal of phases in oil emulsions by electrolytes was discovered by Clowes.[1] Clowes worked with olive oil emulsions in which the aqueous phase was a soap solution, the soap being added directly or formed through saponification of the oleic acid in the olive oil by an aqueous phase of NaOH. Clowes found that, when the salt of a bivalent cation ($CaCl_2$) is in excess in the aqueous phase, the emulsion is of the water-in-oil type, and when the hydroxide of the monovalent cation Na is in excess, the emulsion is of the oil-in-water type. Clowes came to some very interesting and far reaching conclusions on the basis of his experiments. It does not appear that he worked with emulsions in which the stabilizing agent is some colloid other than soap.

Clowes saw in the behavior of oil and water emulsions (in which soap is the emulsifier) an explanation of changes in protoplasmic permeability. It is now believed (by some biologists) that monovalent cations increase permeability of the plasma membrane, while bivalent cations decrease permeability. The hydroxide of the monovalent cation Na produces in an oil emulsion (with a soap stabilizer) a system in which the continuous phase is water. Such a system would be readily permeable to water soluble substances. Salts of bivalent cations, such as $CaCl_2$, produce an emulsion in which oil is the continuous phase. Such a system would be impermeable to water soluble substances.

On the basis of the similarity of the reactions of oil emulsions and of protoplasm to mono- and bivalent cations, Clowes has conceived of living protoplasm in contact with water as a system which is, within the protoplasmic mass, a dispersion of proteins, lipoids, etc., in water, and, at its surface, a system of the reverse type, in which water is dispersed in an external continuous fatty or lipoid phase. Clowes does not, however, regard the surface layer of protoplasm as a system in which the aqueous phase is wholly discontinuous, but rather as a system in which the continuous lipoid phase is permeated by water channels, *i.e.*, as an emulsion which is near the reversal point.

Clowes has assumed that the stabilizer active in the supposed protoplasmic emulsion is either soap or a substance which is like soap in its reaction to mono- and bivalent electrolytes. While soaps are present in protoplasm it does not seem likely that they are the emulsifier which determines the behavior of the supposed living emulsion when other possible emulsifiers such as proteins and lipoids are present in much greater quantities.

I had the pleasure of discussing phase reversal in emulsions with Mr. Hatschek, of London.

[1] Clowes, G. H. A., "Protoplasmic equilibrium," *Jour. Phys. Chem.*, 1916, xx, 407-451.

Mr. Hatschek called my attention to the fact that if the emulsifier in an oil emulsion is some colloid other than soap, for example, gum arabic, the emulsion will not reverse when a bivalent electrolyte is added to it. With the kind permission of Mr. Hatschek I have repeated and extended his preliminary experiments.

The manner of making the stabilizers and the emulsions, with also the methods employed in determining the type of system, will all be fully described in a subsequent publication.

Oil emulsions in which sodium oleate or sodium stearate is the emulsifier are of the oil-in-water type and are reversible with $BaCl_2$.

Oil emulsions with casein, gliadin, cholesterin, or cephaelin as the aqueous phase, are of the water-in-oil type and are reversible with NaOH.

Oil emulsions in which saponin (senegin, smilacin), gelatose, gum arabic, albumin, lecithin, or a plant extract is the emulsifier, are oil-in-water systems which are *not* reversible with $BaCl_2$.

It is of interest to note that of three proteins, all present in protoplasm, the most abundant one, albumin, does not permit reversal, while the two others do; and of two lipoids, both constituents of living matter, one, lecithin, does not, and one, chloresterin, does permit reversal. Further, the plant extract (obtained by grinding and pressing fresh spinach), which one might expect to approach somewhat the chemical make-up of protoplasm, does not permit reversal.

Who can tell what the emulsifier in the supposed living emulsion actually is?

Since the hypothesis of Clowes rests on the assumption that the emulsifier in protoplasm is of that type which forms an emulsion which is reversible with $BaCl_2$ or NaOH, and since certain of the substances here experimented with as emulsifiers, are very abundant in protoplasm but form emulsions which are not reversible with $BaCl_2$ or NaOH, one is forced to conclude that, in view of the fact that we are totally ignorant of the actual nature of the active emulsifier in living matter, a theory of the mechanism of permeability changes which is based on the behavior of only one group of emulsions, must be regarded as a purely speculative hypothesis which rests on very uncertain evidence.

It is of further interest to note that NaCl will not reverse any of the reversible emulsions here studied, yet it is this salt which causes (in the opinion of some investigators) such a pronounced increase in the permeability of protoplasm.

Quite aside from the experimental facts here given, it should be pointed out that the hypothesis of Clowes, like so many other interesting speculations on protoplasmic behavior in general and on permeability changes in particular, rests on two very fundamental assumptions (in addition to the one above discussed) in support of which there is no substantial evidence.

It is assumed by Clowes, and indeed by most biologists as well, that protoplasm is an emulsion in which a reversal of phases is of common occurrence. The emulsion hypothesis of protoplasmic structure is still adhered to by many biologists in spite of the fact that there is in all physical chemistry no *conclusive* evidence that any lyophilic colloid, of which protoplasm is one, is a liquid-liquid system. That the dehydrated lyophilic colloids starch and cellulose are crystalline has been shown to be true by the work in Roentgen ray spectography of Herzog. Although this does not necessarily tell us what the hydrated colloid is like, the consensus of opinion among colloid chemists seems to be that the dispersed particles of the hydrated colloid, in a gelatin sol for example, are solid. In the process of hydration there apparently takes place a breaking down of larger crystalline aggregates into smaller ones, which may even approach the gelatine molecule in size. I believe that I am not misinterpreting the writings of McBain, Freundlich, Proctor[2] and Bachmann when I state they are of this general opinion.

Regardless of the physical nature of the colloidal particles—and after all, as Hatschek has pointed out, the distinction between liquid and solid becomes somewhat vague with particles approaching ultramicroscopic dimensions—there is no evidence that a reversal of phases takes place in the process of gel formation from the sols of lyophilic colloids. On the contrary, the work of Bachmann and Zsigmondy and of Mc-

2 Proctor, H. R., The structure of elastic jellies, *Phys. and Chem. of Colloids, Rep. Faraday Soc. and Phys. Soc.*, London, 1921, 40-43.

Bain has shown that in gelatin and in soaps, and therefore probably in many other if not all lyophilic colloids, *there is no reversal of phases in the formation of a gel,* but merely an aggregation of the colloidal particles—the dispersion medium in the sol is still the dispersion medium in the gel. The conception of a reversal of phases in the process of gelation owes its origin to the earlier supposition that the lyophilic colloids are liquid-liquid, "emulsoid" systems, an idea which is not now held by such chemists as Donnan, Freundlich, McBain and Zsigmondy. One wonders, therefore, how far we dare go in our phase reversal speculations on the mechanism of permeability changes and similar vital phenomena.

The full account of the experimental data here briefly reported will include a discussion of the remarkable behavior of the emulsion with a gelatose emulsifier. This is an emulsion of the oil-in-water type and is reversible, in the *same* direction with the hydroxide of either the bivalent cation Ba or the monovalent cation Na, but not with the salt of either cation. There will also be published data on the possible influence of acidity on phase reversal. That pH value is a factor in phase reversal is apparently true in certain cases, but that it is the determining factor in other cases is certainly not true. H-ion concentration must affect the ability of an emulsion to reverse through acting on the emulsifier—possibly the hydration power of the emulsifier—consequently, the effect of pH will differ in emulsions with different emulsifiers, and this the experiments show to be true.

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ACTIVE HYDROGEN BY THE ACTION OF AN ACID ON A METAL

EVIDENCE for the formation of active hydrogen from its positive ion in an acid has been negative. The reports of the latest workers in this field, Wendt and Landauer[1], show that there are certain difficulties to be met. The main one is to eliminate the moisture that accompanies a rapid evolution of hydrogen and at the same time not destroy the active hydrogen if any were formed. If the gas stream were too low a velocity the active component would decay before reaching the sulfur. Then if the velocity were too high the moisture carried over would form a protecting film on the powdered sulfur and prevent the reaction between the two to form hydrogen sulfide.

During the work on the activation of hydrogen by corona discharge it was found by Wendt and Grubb[2] that active hydrogen combines with pure nitrogen to give ammonia. This method of testing for active hydrogen can be used to good advantage where moisture is carried along with the evolved hydrogen, since the spray does not prevent the contact of active hydrogen and the nitrogen.

If hydrochloric acid or sulfuric acid is dropped upon metallic magnesium suspended in such a way that the metal is at no time immersed or partly covered with any large portion of liquid, the drop of acid can react with the metal in the shortest possible time. This gives off hydrogen very rapidly, in fact, almost explosively, and with a minimum quantity of spray. If this evolved hydrogen is brought in contact with pure nitrogen it is found that ammonia is formed readily. The active hydrogen was then passed through a plug of glass wool before coming in contact with the pure nitrogen. The activity of the hydrogen still persisted as shown by the formation of ammonia. Therefore, the activity of the hydrogen cannot be due to ions or atomic gas. But Langmuir[3] has shown that monatomic hydrogen does not react with nitrogen to form ammonia. In view of this fact, if we allow pure nitrogen to escape at the surface of the magnesium where the hydrogen is evolved we find a maximum quantity of ammonia formed. The amount of ammonia formed increases with an increase in the rate at which the acid is dropped upon the metal. This of course means that the amount of the active component varies with the velocity of the gas stream.

If the acid is dropped on the metal very slowly and the evolved hydrogen passed through glass wool before coming in contact with nitrogen, no ammonia is formed. This indicates that

[1] Wendt and Landauer, *Jour. Am. Chem. Soc.,* xlii, 930, 1920; *Ibid,* xliv, 510, 1922.

[2] Wendt and Grubb, *Ibid,* xlii, 937, 1920.

[3] Langmuir, *Ibid,* xxxiv, 1324, 1912.

the active hydrogen has reverted to the ordinary before meeting the stream of nitrogen. The life of the active gas seems to be not longer than two minutes. This checks very closely with the life of triatomic hydrogen formed by other methods.

These results seem to substantiate the theory of Wendt and Landauer, namely, that triatomic hydrogen ought to be produced wherever atomic hydrogen is evolved. It is reasonable then to expect that a higher per cent. of active hydrogen would be found in the gas evolved from the surface of the metal than in the molecular hydrogen subject to electronic bombardment in a discharge tube. In the former all the hydrogen evolved goes through the atomic state while in the latter case only a very small amount of atomic gas may exist at one time. The discharge would also destroy some of the active variety.

The preliminary results to determine the per cent. of activation are in harmony with this theory. Further work is in progress to determine the quantitative relations of some of the factors involved.

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SLIDE HOLDERS FOR OVERCOMING A DEFECT IN ATTACHABLE MECHANICAL STAGES[1]

THOSE employing attachable mechanical stages no doubt have encountered, the same as the writer, an unsatisfactory feature in their construction leading to frequent annoyance and delay in examining slides. This relates to the portions of the stage between which the slide is clamped. Instead of resting all but in contact with the stage of the microscope, they frequently lie in a plane sufficiently above the same to permit slides, especially the thinner ones, to become wedged beneath, thus interfering with a free movement of the stage. Stages undoubtedly present a range of variations in this respect. The writer has found the defect present to a certain degree in all stages used by him thus far, belonging to two makes.

The devices or slide holders here described are designed to obviate the difficulty. They are designed for a Spencer stage, but there is no reason why they should not be readily adapted to other makes.

The one shown in Figure 1 was made from No. 20 brass wire. It is a little shorter and somewhat broader than the slide to be carried. The upward projecting loops at *a*, *b*, and *d*

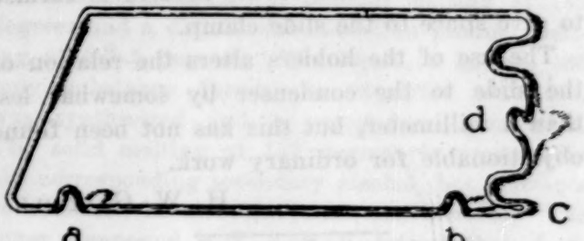


FIG. 1

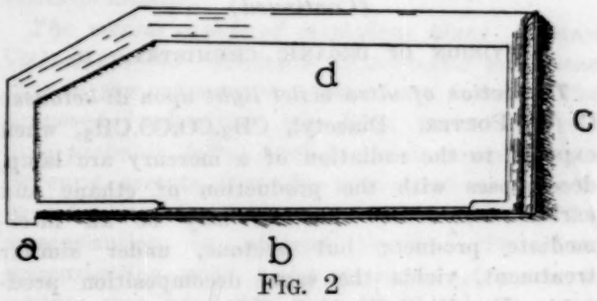


FIG. 2

should be tilted inward a little. They serve as supports for the back and right edge of the slide and also prevent the holder from becoming wedged beneath the stage in the same manner as slides. The end of *c* should be bent up very slightly to avoid wedging. The portions of the back of the holder having contact with the mechanical stage should be flattened with a file to give good contact and prevent the holder from slipping up. This holder is very readily made with no more tools than a round and a flat-nosed pair of pliers. The ends of the wire should be joined by being clamped in a thin metal sleeve. The holder should be straightened and made to lie perfectly flat by testing it out on a table or some other plane surface.

The design shown in Figure 2 was cut from sheet brass of about the thickness of the above No. 20 wire. Its size is such that the end of the slide is flush with that of the holder and the front edge reaches to *d*. The edges *b* and *c* are first turned up to provide support for the

[1] From the Department of Animal Pathology of the Rockefeller Institute for Medical Research, Princeton, New Jersey.

back and right edge of the slide. These are then cut down to a height slightly exceeding the thickness of a slide. The edge at the point *a* should not be turned up but permitted to project very slightly beyond the back line, thus furnishing a secure contact with the back of the stage. This holder is more rigid than the first but requires more time and equipment to make it.

The left front end of the holders is formed to give space to the slide clamp.

The use of the holders alters the relation of the slide to the condenser by somewhat less than a millimeter, but this has not been found objectionable for ordinary work.

H. W. GRAYBILL

THE AMERICAN CHEMICAL SOCIETY

(Continued)

DIVISION OF ORGANIC CHEMISTRY. II.

The action of ultra violet light upon di-ketones: C. W. PORTER. Diacetyl, $CH_3.CO.CO.CH_3$, when exposed to the radiation of a mercury arc lamp, decomposes with the production of ethane and carbon monoxide. Acetone may be an intermediate product; but acetone, under similar treatment, yields the same decomposition products. Benzil, $C_6H_5.CO.Co.C_6H_5$, in the solid or in the molten state is not decomposed by u. v. l. When vaporized and exposed to u. v. l. it slowly decomposes, forming benzophenone, carbon monoxide and a charred residue. In dry benzene solution benzil is not affected by light. An aqueous solution of benzil, in absence of air, yields benzoic acid, benzaldehyde and benzoin. Benzilic acid is not produced. Solutions of benzil in mixtures of alcohol and water yield the same products. In the presence of oxygen a water-alcohol solution of benzil (2 g. per liter) yields benzoic and salicylic acids. The reaction is completed within twelve hours.

Motion picture demonstrations of laboratory apparatus: H. T. CLARKE.

The determination of mucic acid: E. O. WHITTIER. Mucic acid, tartaric acid or racemic acid may be determined in acid solution by oxidation with excess of standard potassium permanganate solution at boiling temperature, followed by a back titration with standard oxalic acid and standard permanganate. The relationships between these acids and permanganate are not stoichiometric, due to formation of some formic acid. Oxalic acid and mucic acid may be precipitated together quantitatively as calcium salts, dissolved and determined in the presence of each other, the oxalic acid being titrated at 50°C., the mucic acid at 100°C.

Dipropargyl methylene ether: HERBERT H. GUEST. This communication is a preliminary description of the preparation and properties of the methal of propargyl alcohol, and the attempt, so far unsuccessful, to utilize this acetal in the synthesis of the higher acetylenic alcohols of the type $RC \equiv C—CH_2OH$. Bis (2.3 dibromopropyl) methylene ether (A) $(CH_2Br—CHBr—CH_2O)_2—CH_2$ viscous oil $b_{10mm.}$ 220° was prepared by the action of a 2 per cent. HCl solution of 2.3 dibromohydrin on paraformaldehyde, and also by the use of anhydrous $FeCl_3$ and $CaCl_2$, respectively, as catalysts. Bis (2 bromoallyl) methylene ether (B) $(CH_2 = CBrCH_2O)_2CH_2$, oil $b_{10mm.}$ 135—40°C, from A by the action of finely powdered KOH in Et_2O solution. Di propargyl methylene ether (C), $(CH \equiv C—CH_2O)_2—CH_2$, oil $b_{10mm.}$ 75—80°C. was obtained in 50 per cent. yield from either A or B by heating with 4 mols. KOH dissolved in 4 vols. EtOH at 100°C. C reacts with Et Mg Br with evolution of C_2H_6 and formation of an oil insoluble in Et_2O. It gives an insoluble Ag salt $(AgC \equiv C—CH_2O)_2CH_2$ which explodes on heating and reacts very slowly with Na. These metallic derivatives of C were treated under varying conditions with alkyl halide, *e.g.*, C_4H_9Br in the attempt to form $(C_4H_9C \equiv C—CH_2O)_2CH_2$, but without any evidence of this reaction taking place.

The reaction between aryl esters of sulfonic acids and organomagnesium halides: CHARLES H. MEYERS and HENRY GILMAN. In connection with a study of methods for the introduction of aryl groups, an investigation is being made of the reaction between aryl esters of various acids, organic and inorganic, and organomagnesium halides. It has been found that when aryl esters of aromatic sulfonic acids are used the chief products are sulfones.

Secondary aliphatic—aromatic arsines, C_6H_5AsRH: C. SHATTUCK PALMER. This new series of arsines has been prepared by the action of alkyl halides on an alcoholic solution of the sodium derivative of phenylarsine, C_6H_5AsNHa. The products are colorless oils, which fume strongly in the air, but are not spontaneously inflammable. They are oxidized by air to a mixture of arsine oxide, $C_6H_5R\ As—O—AsRC_6H_5$, and arsinic acid, $C_6H_5RAsO_2H$, in which the latter constituent is present in much the larger pro-

portion. With halogens arsine halides, C_6H_5RAsX are formed, and with alkyl halides, quaternary arsonium halides, $C_6H_5R_3AsX$. The reaction with secondary arsine halides, R_2As Cl and RR'AsCl, has made possible the preparation of several previously unknown types of cacodyls.

Arsenated N—arylamino alcohols (By title): CLIFF S. HAMILTON. Ethylene chlorohydrin reacts with sodium arsanilate to give p-arsono-2 anilino-ethanol. Its sodium salt separates from alcohol in colorless crystals. By treating the arsonic acid with sodium hydrosulfite the corresponding arseno-compound is prepared. In a similar manner, trimethylene chlorohydrin reacts with sodium arsanilate to give p-arsono-3 anilino-propanol. Its sodium salt and the corresponding arseno derivative have been prepared. Other compounds are in the course of preparation.

A new photochemical color reaction (with demonstrations): LAWRENCE W. BASS AND OSKAR BAUDISCH. It has been found that a mixture of bromoform, iodoform and indol, which is stable in the dark, is very sensitive to diffused daylight or electric light, giving a deep red color in a few seconds. Because of the rapid color change in daylight the reaction is particularly valuable for various photochemical lecture experiments. At the same time the reaction may be used as a sensitive test for indol.

The syntheses of some derivatives of the tetrahydro benzo-furane ring: A. E. OSTERBERG AND E. C. KENDALL. Thyroxin is a tetrahydro derivative of indol. Compounds which are tetrahydro derivatives of benzo-furane with the double bonds in the molecule bearing the same relationship as in thyroxin have been prepared. The chemical and physical properties of these compounds are described. Their reaction toward halogens, the ease with which the lactone and ester groups saponify and their stability toward oxidation and alkalis are discussed.

Acetyl-benzoyl derivatives of o-hydroxybenzylamine and o-aminobenzyl alcohol: L. CHAS. RAIFORD AND E. P. CLARK. In work previously reported from this laboratory (*J. Am. Chem. Soc.*, 41,2068 (1919); 44,1739 (1922) and 45,469 (1923)) it has been shown that when 2-acetylaminophenol is benzoylated in accordance with the Schotten-Baumann method, the benzoyl radical attaches itself to nitrogen, while acetyl migrates to oxygen, but that this rearrangement does not take place when para derivatives are involved. In continuation of this work and particularly on account of the results obtained by McConnan and Titherly and Auwers and collaborators, in which it was found that acetyl wandered from oxygen (bound to the nucleus) to nitrogen (situated on a side chain), the behavior of the derivatives of o-hydroxybenzylacetamide and its isomer o-acetylaminobenzyl alcohol have been examined. No migration of acetyl was observed but, instead, two isomeric acetyl-benzoyl derivatives were isolated in each case.

The reduction of benzalpinacoline: G. A. HILL AND C. S. SPEAR. Benzalpinacoline was treated with a variety of reducing agents and yielded three compounds, a high boiling point liquid, a monomolecular reduction product melting at 142 degrees and a dimolecular reduction product melting at 208.5 degrees. The liquid, a ketone, the only substance formed in catalytic reduction, was synthesized and is omega-benzylpinacoline. The solid melting at 142 degrees is presumably the corresponding secondary alcohol, but attempts to establish its structure were unsuccessful. The other compound is 2, 2, 9, 9, tetramethyl, 5, 6, diphenyl decandione, 3, 8. It was synthesized from the hydrochloric acid addition product of benzalpinacoline.

The mercurization of methylene blue: LYMAN CHALKLEY, JR. Attempts to mercurize methylene blue in the ordinary way have been failures. The proposed explanation has been that methylene blue probably forms such a stable complex with mercuric acetate that the concentration of mercuric ion is reduced below the value necessary for mercurization to proceed readily. Therefore, mercurization with a large excess of mercuric acetate was tried. It was found that benzoyl-leuco-methylene blue could be mercurized if about three molecules of mercuric acetate were used. The work upon methylene blue itself is not complete, but small yields of two organic mercury derivatives have been obtained.

Structure of isocampholactone: P. K. PORTER WITH W. A. NOYES. When isocampholactone is heated for some days with moderately strong nitric acid, the two principal products formed are nitroisocampholactone and a lactone acid: $O_2N\text{-}C_8H_{13}\text{-}CO$ and $HOOC\text{-}C_7H_{11}CO$.

This lactone acid gives an amide which on treatment with sodium hypobromite is converted to a ketone acid $HOOC\text{-}C_7H_{11}{=}O$. This ketone on treatment with methyl magnesium iodide regenerates isocampholactone and also forms another acid which is probably the trans hydroxy acid which might be expected. This series of reactions demonstrates that isocampholactone contains methyl groups in the 1, 2, 3 positions instead of the 1, 2, 2 positions of camphoric acid. Nitroisocampholactone on treatment with an alkali gives, almost quantitatively, acetone and a nitro acid which probably has the structure,

CH_2-$C(CH_3)$-COOH. The work on the acid is
| |
CH_2-CH-NO_2
not, however, completed.

The biological and chemical significance of gamma sugars: J. C. IRVINE. The paper deals historically with the accumulation of evidence showing that reducing sugars can react in isomeric forms which differ in the position occupied by the internal oxygen ring. The general expression "gamma sugars" has been applied to the varieties in which the ring is displaced from normal stable position and the reactions of these sugars proceed with a facility which distinguishes them sharply from ordinary forms. No gamma sugar has been isolated in the free state, but their properties are indicated by the reactions of their methylated derivatives, several examples of which will be described. The suggestion is put forward that the elaboration of sugars in plants and their subsequent utilization by animals depend primarily on the transient formation of gamma sugars and not on the stable isomerides which constitute our standard examples of aldoses and ketoses.

A survey of the glucose molecule with reference to the formation of disaccharides and polysaccharides: J. C. IRVINE. If the molecule of glucose is considered in the light of its capacity to form derivatives such as disaccharides and polysaccharides, it is clear from the results of recent research that attention must be focussed on two positions, indexed as 1 and 5 in the following formula:

CHOH-CHOH-CHOH-CH-CHOH-CH_2OH
|.....O_.....|
1 2 3 4 5 6

The No. 1 position, which constitutes the reducing group, takes part in the formation of glucosides and of non-reducing disaccharides such as sucrose. On the other hand, position 5 is involved in the formation of certain reducing disaccharides as, for example, lactose and cellobiose. In the case of the polysaccharides which are based on glucose, both of the hydroxyl groups (1 and 5) take part in the coupling, the best example being provided by cellulose in which no other linkage is present. Precisely the same structural feature is present in starch and in glycogen, where at least one maltose residue is attached to glucose through positions 1 and 5. This dissection of the function of each hydroxyl group in glucose serves to illustrate the simplicity and uniformity of the linkages involved in complex natural carbohydrates.

The oxidation of mannitol, sorbitol and dulcitol: CARL W. HOLL AND W. L. EVANS. These hexitols were oxidized with alkaline and neutral potassium permanganate at 25, 50 and 75 degrees. The final reaction products were carbon dioxide, oxalic and acetic acids. Oxalic acid reaches a maximum value and the carbon dioxide a minimum value at about 0.1 N alkali. In studying the mechanism of these reactions, l-arabitol, d- and l-arabinose were also oxidized under the same conditions as the hexitols. No difference was detected in the amounts of the reaction products obtained in the arabonic series at a given alkalinity, the final products being the same as those obtained in the hexitols. The following compounds and mixtures were also oxidized: Glycerol, glyceric aldehyde (solid), erythritol and glycollic acid, l-arabinose and formaldehyde.

The aniline derivatives of citric and aconitic acids: E. B. BROWN AND J. R. BAILEY. Pebal prepared the so-called citranilic acid, to which has been assigned the structure

$$\begin{matrix} HOOC\text{-}CH_2\text{-}CH\text{-}CO \\ \qquad\qquad\quad | \\ \qquad\quad CH_2\text{-}CO \end{matrix} = N\text{-}C_6H_5$$

In a previous paper before the organic section of the society we reported experiments aimed at the preparation of the isomeric citranilic acid by the action of aniline on methylene citric anhydride, with subsequent hydrolysis of the methylene anhydride. This method of preparation gives a substance different from the Pebal compound, but under certain conditions the two products yield identical reaction products. We find that the two compounds with PCl_5 give the same aconityl anil and with C_2H_5OH-HCl the same ethyl citranilate. This ester with alcoholic ammonia yields first an amide anilide ester of citric acid, which on further reaction with ammonia gives a diamide anilide of citric acid. With alcoholic KOH the ester gives a potassium salt of an anilide ester of citric acid and with PCl_5 there is produced an anil ethyl ester of aconitic acid. Skinner and Ruhemann prepared an aconityl anil to which is assigned the formula

$$\begin{matrix} HOOC\text{-}CH = C \quad \text{-}CO \\ \qquad\qquad\quad | \qquad\quad | \\ \qquad\quad CH_2\text{-}CO \end{matrix} = NHC_6H_5$$

while W. Bertram made the corresponding methyl and ethyl esters. Our aconityl anil, its methyl ester made from this by CH_3OH-HCl and the ethyl ester prepared as described above, all differ from the corresponding derivatives to which reference has been made. We do not wish to advance structural formulas for the different substances involved in our work until further investigation has cleared up certain doubtful points.

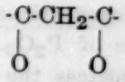
Dimethylcyclopentenealdehyde: R. R. READ AND HAROLD HIBBERT. The structure of the aldehyde produced by the electrolytic reduction of crotonaldehyde has been established by its synthesis from the latter through the intermediate products

b-brombutyraldehyde diethyl acetal and the tetra ethyl acetal of 3.4 dimethyl hexanedial.

The preparation of the benzilmonoximes and a monotropic modification of gamma benzilmonoxime: FREDERICK WILLIAM ATACK AND ALICE HARRINGTON ATACK. In the course of an attempt to prepare the third isomeride of benzilmonoxime, which should exist in accordance with Atack's theory of the structural isomerism of oximes (J. C. S., 1921, 119, 1175), the existence of a monotropic modification of gamma benzilmonoxime has been noted. Alpha benzilmonoxime has been prepared by Forster and Dunn (J. C. S. Trans., 1909, 95, 431) by the interaction in pyridine solution of benzil and hydroxylamine, prepared by the action of powdered sodium hydroxide on powdered hydroxylamine hydrochloride in pyridine suspension. It has now been found that if the hydroxylamine is prepared by the action of sodium bicarbonate on hydroxylamine hydrochloride in presence of a limited amount of water, continuing the preparation in pyridine solution by the method of Forster and Dunn, almost pure gamma benzilmonoxime is obtained, the crude material being identical with that obtained by Auwer's method (action of hydroxylamine hydrochloride on benzil dissolved in hot sixty per cent. ethyl alcohol). The crude material melts in each case at 102-104 degrees C. and mainly consists of an apparently monotropic modification of the gamma benzil monoxime, which can be isolated in a pure form from alcohol solution (m. pt. 106 degrees); on recrystallizing from benzene and heating to remove benzene present in the addition compound, the known gamma benzilmonoxime of m. pt. 113 degrees is obtained. This can be reconverted into the modification of lower melting-point by solution in alcohol.

Ethers of diethyl malonate and barbituric acid: A. J. HILL AND DEWITT T. KEACH. As an extension of previous work, the writers have shown that chloroethers of the general formula, R-O-CH_2Cl (R = CH_3, C_2H_5, C_3H_7, C_4H_9, $C_6H_5CH_2$, etc.) may be utilized for the alkylation of diethylmalonate and its mono-alkylated derivatives, in particular, diethyl ethyl malonate. These new malonic esters combine smoothly with urea, in the presence of alcoholic sodium ethylate, giving ethers of barbituric acid. The investigations are primarily designed to establish new facts bearing on the relation between the chemical constitution of barbituric acid ethers and their physiological properties.

Condensation reactions of acetylene: HARRY HOFFMAN AND J. A. NIEULAND. Formation of cyclic ethylidene ethers results when glycols are treated with varying parts of strong sulfuric acid not over twenty per cent., usually less than ten per cent., to which less than .01 per cent. of mercury sulfate is added as catalyst and dry pure acetylene gas is passed into the mixture. In this way a new compound, tetraethylethylidene ether (B.P. 95 degrees C.) is obtained, also trimethylene ethylidene ether, etc. The labile hydrogen in groups



is also thus replaceable forming, *e.g.*, in case of malonic ester and acetylene, ethylidenemalonic ester, etc. Benzaldehyde and its homologues introduce acetylene with the formation of cinnamic aldehyde according to the reaction $C_6H_5CHO + CH \equiv CH + (cat.) = C_6H_5CH = CH\text{-}CHO$. The best synthetic yields hitherto obtained result from the process.

The constitution of coal tar: JOHN MORRIS WEISS AND CHARLES RAYMOND DOWNS. A description is given of an exhaustive analysis of coal tar based on the distillation in the plant of about 20,000 gallons of coal tar oil and its separation into very close fractions which we later examined in the laboratory. By this means analytical methods for the principal compounds in coal tar were developed. The paper does not give these analytical methods in detail but does give the results of the composition of an average sample of American coke oven tar, showing the proportions of the constitutions in the tar which exist in appreciable amounts.

On derivatives of the sulfur analog of choline: R. R. RENSHAW and N. BEKUNOWITZ. Several sulfonium compounds have been prepared including the acetyl formocholine analog. Their physical and chemical properties are being compared with corresponding derivatives of nitrogen and phosphorus, and attempts will be made to correlate these properties of the different compounds with their curare, nicotine and muscarine effects. Reid Hunt is making the pharmacological investigation of these substances. This work is being carried on with funds donated from the Bache Fund.

The constitution of N, N, 2, 2, 2, dichlorohydroxyethylidene-bis-nitroanilines: A. S. WHEELER and S. C. SMITH. In a paper published by Wheeler in 1903 the constitution of these compounds was given as $(NO_2C_6H_4NH)_2CHCCl_2OH$. Since other compounds containing the grouping $-CCl_2OH$ are not known, these products were reexamined and constitutional studies now show that in the preparation of these compounds from the trichloro derivative by the action of alco-